Essays on Financial Distress and Stock Returns

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論文内容の要旨

From the perspective of a company, debt is one of the most preferred means of financing and is widely used to achieve various financial goals. Despite being a convenient mean to magnify the profit / return from a certain project / business, possessing too much debt might endanger the very going concern of a company. This is loosely defined as “financial distress” risk. Myers (1976), Kaplan and Stein (1993),and Ross (2008) imply that more debt a company has the more risk that the company will suffer from financial distress. Financial distress condition can make a company go bankrupt or, at least, be reorganized (Ross, 2008). This condition could put investor’s money into a substantial amount of risk.

Given the importance and severity of the impact of financial distress, it is important as to be able to understand the implications of financial distress risk in a company, as well as to be able to predict the financial distress condition. An important discussion in the field of financial distress study is the modeling and analysis of its effect on stock returns, the theme that we aim to address in this dissertation.

In this dissertation, we deal with financial distress topic and its consequences. Fours research objectives are addressed: (i) construct financial distress prediction model using Japanese firm data; (ii)

evaluate the relationship between financial distress condition of a firm and its subsequent stock returns; (iii) examine the Modigliani-Miller theory (1963) and its application in Japanese market; and (iv) examine the optimal debt level from stock returns perspective.

Our samples are non-financial, publicly listed firms in TSE from 1980-2014. In order to avoid survivorship bias, we also include delisted firms during the period. Both stock returns and financial data are obtained from NIKKEI NEEDS database. It is to be noted that the actual usable observations vary with the data required in each chapter. For analysis in Chapter 3 and Chapter 4, the financial data of firms are crosschecked with monthly stock returns data.

Chapter 2

In Chapter2, we construct several financial distress prediction models and examine their prediction powers. We prepare 23 financial ratios for each year in the horizon. We obtain the financial data from NIKKEI NEEDS financial database. The firm in a particular year must have previous year's financial statement in order to be selected as sample. After eliminating missing data, the sample set contains 81,826observations, among them there are 578 cases of distress and 81,248 cases of non-distress[1].Wedivide the sample into 2 sub-samples:70%training (57,329 observations) and 30% validation (24,497 observations) sub-sample sets.

We prepare 23 financial ratios for each year in the horizon. These 23 ratios are derived from financial ratios used in several selected previous studies, that include profitability, liquidity, efficiency, cash position, and financial leverage ratios. We then attempt to link them with the particular firm's distress condition in the following year (t+1). Next, we perform stepwise Logit and stepwise Discriminant Analysis (DA) procedures on the ratios. These procedures are performed to determine the best ratios to be included in the final model, based on their statistical significance to the condition of future financial distress of the firm and their relative contribution to the final model. The next step is to run a permutation of each of the two sets of selected variables into two models: logistic regression and discriminant analysis, from which we have four sets of models. We then assign a proper cutoff point, i.e. the threshold point where a firm is classified as either distress or non-distress. The models are evaluated based on their accuracy (number of correct prediction divided by total sample) and error rates, both Type 1 (number of distress companies being predicted as non-distress divided by the total number of companies that are actually distress) and Type 2 error rates (the number of non-distress companies being predicted as distress divided by the total number of companies which are actually non-distress). Furthermore, we perform ROC curve analysis to strengthen our conclusion on the predictive powers of the models.

From this whole process, we are able to determine the best performing model is a logistic regression that includes the following ratios: Earnings before Tax / Total Equity, Total Liabilities /

[1] Full sample set contains 86,450 observations (82,157 active and 4,293 delisted firms). Among them, there are 4,624 cases of missing data (3,220 cases in training and 1,404 cases in validation sub-sample sets).

Total Asset, Retained Earnings / Total Asset, Logarithm of Earnings before Interest and Tax / Interest Expense, and Net Income / Total Asset.

$$\text{distress} = \frac{1}{1+e^{-y}}$$

$$\text{where } y = -18.088 - 0.038EBTEQ + 1.255RETA + 15.588TLTA - 1.103LOGEBITINT + 5.746NITA \quad (2.5)$$

The most efficient cutoff point is 0.017; therefore, if a firm's probability of distress exceeds 0.017, we classify the firm as being financially distressed. This model possesses superior type 1 error rate characteristics, suggesting that this model is suitable for risk-averse users that aim to minimize the risk of misevaluating a distress firm. We name this model YSCOREJ, and bring forward this model onto the next chapter.

Chapter 3

Chapter 3 investigates the relationship between financial distress and subsequent stock returns, and analyzes the effectiveness of financial distress prediction model's output as predictor of future returns. Previous studies confirm the argument that among the risk factors, the default or distress risk is one of the most important explanatory factors for stock returns (Fama and French, 1993; Chen et al., 1986). Nevertheless, contrasting results have been documented by researchers in term of the basic conjecture that high risk factor firm provides higher returns for its investors. A group of studies provide empirical proof that the firms with higher probability of financial distress tend to have lower, not higher, stock returns in the future. This group includes Dichev (1998), Griffin and Lemmon (2002), Campbell et al. (2008), Avramov et al. (2009a), and George and Hwang (2010). On the other side, results from Shumway (1996), Vassalou and Xing (2004), Chava and Purnanandam (2010), Kapadia (2011), and Avramov et al (2013) suggestthat the firms with high distress risk factors exhibit largest stock returns. As such, it is interesting in joining the discussion on the relationship between financial distress and stock returns.

We measure financial distress using three financial distress prediction models, i.e. classic Total Asset to Total Liabilities (TLTA) ratio, the modified Altman (1968) Z-Score model (ZSCORE)[2], and our own YSCOREJ model[3]. We also employ two control variables: Book-to-Market ratio and size, as measured by Logarithm of Market Value of Equity. We also measure stock returns by both absolute returns (RET) and excess returns (XCSRET), i.e. the difference between absolute returns and Nikkei 225. We calculate the average of returns for RET and XCSRET figures for 12 months period, starting from the 4th month after fiscal year end. For example, the RET of a firm that ended its fiscal year on March 1999 is the average of its monthly return from July 1999 to June 2000. We decide on the

[2] The coefficients of Altman Z-Score model are modified using Japanese firm data. We still retain the model's original variables, and utilize similar technique as in original study (Multivariate Discriminant Analysis).

[3] Readers can refer to Chapter 2 for the details of the model construction.

3-month gap between the financial figures on fiscal year end and the start of the monthly return calculation to allow for the financial statement information to be fully digested and adjusted in the stock price.

The comprehensive analysis of the effect is conducted on three layers of analysis. The first is a GLS regression analysis[4], using RET and XCSRET as the dependent variables and the distress proxies (TLTA, ZSCORE, and YSCOREJ) as independent variables. It is also to be noted that we analyze both the raw score and the binary output of each distress proxy. All the variables are analyzed on different regression models. As for the time horizon, the regression is conducted using annual returns at one year after (t+1) up to four years after (t+4) distress measurement. Second, we perform an analysis on 10 portfolios created on the basis of the raw scores of the three distress proxies. We rank all the stocks and include them in one of the portfolio numbered from 1 to 10, in which Portfolio 1 contains the stocks with highest probability of distress. We analyze the trend and differences of the returns from one year up to four years after portfolio creation. The third layer is long-short portfolio strategy analysis, in which we simulate the returns obtained if we perform a certain strategy by utilizing the findings from both the GLS regression procedure and the 10 portfolio approach

All three of our analyses generate consistent evidences that portfolios with higher distress risk tend to be more likely associated with subsequent higher stock returns than portfolios with lower distress risk. Investors who dare to take risk by investing in firms with higher distress risk are rewarded by higher subsequent stock returns. This suggests that the distress risk is indeed an important factor in equity valuation. This might also warrant further study on validating and exploring the role of distress risk in equity valuation. These findings are consistent with Shumway (1996), Vassalou and Xing (2004), Chava and Purnanandam (2010), Kapadia (2011), and Avramov et al (2013). Our results, however, contradict the findings of the opposite group (Dichev, 1998, Griffin and Lemmon, 2002, Campbell et al, 2008, George and Hwang, 2010). This group of researchers mostly attributes their findings to the phenomenon of market mispricing or as evidences of market inefficiency. However, we argue that the market mispricing argument is to be questioned on the basis of rational market equilibrium theory. If this is an actual mispricing, investors would jump in and take advantage of the mispricing, which would then erase the mispricing itself. The notion of higher risk being rewarded by lower returns is by itself peculiar and counter-intuitive[5].

We also show that financial distress prediction models possess considerably high explanatory power of future stock returns. We also notice that by including the distress risk factor (in the form of

[4] GLS regression method is utilized due to our White and Breusch-Pagan tests suggesting that heteroscedasticity appears in our dataset.

[5] Avramov et al. (2009a), meanwhile, argue that this negative risk-return relation seems to be an anomaly

distress prediction model), the returns regression becomes more reliable. However, we still need to note that book-to-market ratio and size are still significant factors in explaining future stock returns, both absolute (RET) and excess returns (XCSRET).

Chapter 4

Chapter 4 provides evidence that Modigliani-Miller original proposition II with taxes (1963) applies in Japanese financial market. We investigate the relationship between long-term debt level, financial distress, and subsequent stock returns of a firm. This chapter also tries to identify the optimal debt level from the perspective of future stock returns. We argue that the shareholders are expected to largely "ignore" financial distress cost up to a certain debt level point. Above that certain point, the financial distress cost becomes effective, and consequently change the risk-return profile of the shareholders. We perform 2 steps of evaluations: GLS regression[6] to analyze the overall dataset and piecewise linear regression to identify possible breakpoints of the long-term debt level. We employ GLS regression to evaluate the overall effects of long-term debt level to the future returns. Next we apply piecewise regression in our analysis to assess the effect of financial distress cost on the firm's Weighted Average Cost of Capital (WACC).

For this chapter, we define the excess return as the difference between the actual stock return and the risk-free rate (10-year de-annualized JGB yield). LTDTA is the long-term debt over total asset ratio, while LTDTE is the long-term debt over market value of equity. From the perspective of MM theory (1963), LTDTE is the fundamental variable explaining the effects of leverage on cost of equity. In this regression, the coefficient of variable LTDTE represents the (1 -T) (rU -rD) component from equation (4.5) in page 63. Meanwhile, LTDTA serves as the cost related to financial distress (and possible future bankruptcy), and its coefficient represents the slope of f(LTDTA) component from the same equation. BTM and LOGMVE, serving as control variables, are book-to-market ratio and log of market value of equity. Both control variables are adopted from Fama and French (1993) study.

We modify the regression model in equation (4.6) to perform a piecewise regression procedure. For this regression, we break the LTDTA into9 different breakpoints, i.e. from 0.1 to 0.9. After that, we generate a new variable LTDTA2, that is assigned a value of the original LTDTA if the LTDTA is higher than the breakpoint and 0 otherwise. We also add a modified intercept variable called INT2thatis given a value of1 when LTDTA is higher than the breakpoint and 0 otherwise.

We find that after controlling for book-to-market and firm size, statistically long-term debt level indeed serves as a significant factor for future stock returns. This finding lends support to the MM theory(1963), which postulates that a firm's long-term debt to equity ratio as the main driver of the return of its equity (rL). As for the effect of financial distress, we find that when the firm's

[6] See footnote no. 4

long-term debt to total asset (LTDTA) reaches 0.6, the financial distress risk starts to take effect. This causes equity investors to be anxious, resulting in higher stock returns. When the LTDTA reaches 0.7, the bondholder also starts to be anxious about the ability of the firm to payback its debt. This increases both the bond yield (rD) and its contribution to firm's overall WACC, lowering the significance of the return on equity in WACC composition. However, this situation is present particularly in small and medium-sized firms, while the bondholders of large firms seem to be more confident in the firms' ability to repay its debt under financial distress and are less affected by financial distress risk.

Implications and Future Directions

The results we obtain in this dissertation provide several implications for users, especially investors. The new prediction model possesses considerable prediction power that can be used by investors to analyze probability of firm's financial distress. The finding that higher financial distress risk is associated with positive excess returns could help investors in making decisions in long-term investing perspective, especially those who specializes in investing in distressed firms. Moreover, our proof on the working of Modigliani-Miller (1963) theory in Japanese market, not only contributes to the discussion regarding this classic corporate finance theory, but also is able help investors to establish investment decision.

However, we are also aware of several drawbacks in our studies that could potentially be exploited as future research ideas. Firstly, the financial distress prediction model that we construct is still an inherently static model with no regards to time-varying characteristics. Future researchers might want to attempt to construct dynamic prediction models that incorporate time-varying effects. Secondly, with regards to firm's distress risk factor, our finding warrants further study on validating and exploring the role of distress risk in equity valuation, probably under other asset pricing theories. Another approach to explaining distress risk factor is also worth considering, such as by employing time-series analysis rather than treating the data as cross-section.

論 文 審 査 結 果 の 要 旨

本論文は、企業の財務的困難（倒産）予測モデルおよび財務的困難（倒産リスク）の大きさと株式投資収益率の関係に関する3つの研究をまとめたものである。

第2章では、わが国の上場企業に関する財務的困難予測モデル（倒産予測モデル）を構築する。1970年から2014年までの44年間の上場企業財務データ（標本数約81,800）のうち2/3を使用してモデルを構築し、データの残り1/3は予測能力の検証に使用する。まず、過去の研究に基づき23の財務変数を候補としてリストアップし、段階的に変数の追加と削除を行う（stepwise）ロジット回帰と判別分析により、それぞれ4変数と5変数を選択した。次に、5変数に基づくロジット回帰モデルと判別関数、およ

び4変数に基づくロジット回帰モデルと判別関数の計4つのモデルを推定し、その中から最も予測能力の高いモデルを選択する。結果として、5変数を使用するロジット回帰モデルが選択された。このモデルはYSCOREJモデルと名付けられ、3章と4章において、モデルから計算されるスコアを倒産リスクの大きさの代理変数の1つとして使用する。

第3章では、3種類の倒産リスクに関する変数の大きさがその後の株式投資収益率に与える影響を分析する。3種類の倒産リスクに関する変数は ①総負債/総資産(L/A)、②アルトマンのZスコア(ただし、日本企業のデータから推定されたモデルに基づくスコア)、③YSCOREJモデルのスコアである。分析期間は、1980年から2014年までの長期に渡る。まず、株式投資収益率あるいは市場に対する超過収益率を前年度末の倒産リスク変数で説明する回帰分析を行った。結果は、Zスコアを除く2つの変数で有意に正の係数となった。また、各変数の境界値に基づき倒産と予測された場合に1、そうでなければ0を取るダミー変数ではすべての変数で有意に正の係数が得られた。すなわち、倒産リスクが高いとその後のリターンが高いことがわかった。これは参考としたDichev(1998)とは逆の結果である。また、倒産リスクが高いと2年後、3年後、4年後のリターンも高いことを確認しており、影響が長期に及ぶこともわかった。次に、毎年、倒産リスク変数の高い順に十分位ポートフォリオを作成し、運用を継続した場合の平均リターンを比較した。結果として、倒産リスクが高いポートフォリオほど高いリターンが得られる傾向があることがわかった。最後に、倒産リスクが高いポートフォリオをロングし、低いポートフォリオをショートする、ロング・ショート戦略のリターンを確認した。結果は、YSCOREJ以外の2つの変数に基づくリターンと超過リターンともに有意に正のリターンが得られた。以上より、倒産リスクは新たなリスク・ファクターの可能性があることがわかった。

第4章では、株式の資本コストとレバレッジの関係について実証分析を行った。古典的な法人税がある場合の資本構成と資本コストに関するMM理論に倒産コストの影響を加えたトレードオフ理論の実証分析である。資本コストは事後の株式投資収益率から観察されるとし、これを被説明変数に置き、負債/自己資本比率(D/E)を説明変数とする回帰分析を行い、その係数の値を確認する。分析期間は第3章と同じ期間である。結果は、D/Eの係数が有意な正の値となり、MM理論の成立が確認された。また、倒産コストの代理変数としてL/Aを採用し、区分回帰を実施したところ、L/A＞0.6の区間で係数が有意に正となり、倒産リスクがある水準まで高くなると株式資本コストに影響を与えることが確認できた。この結果は、トレードオフ理論と整合的である。なお、株式の資本コストに関して本研究と同様の方法を用いた研究は存在しないと思われる。この点で新規性が高い。

以上、論文の内容を概観したが、本研究では、わが国の上場企業に関して長期間のデータを使用し、倒産リスクとその後のリターン、さらに、レバレッジおよび倒産リスクと、その後のリターンから推測される株式資本コストとの関係を調べ、「倒産リスクが高いとその後のリターンが高い」「株式資本コストとレバレッジおよび倒産リスクとの関係を説明するトレードオフ理論の成立を確認した」という新しくかつ興味深い知見を得ている。よって本論文は博士(経営学)論文として「合格」であると判定する。